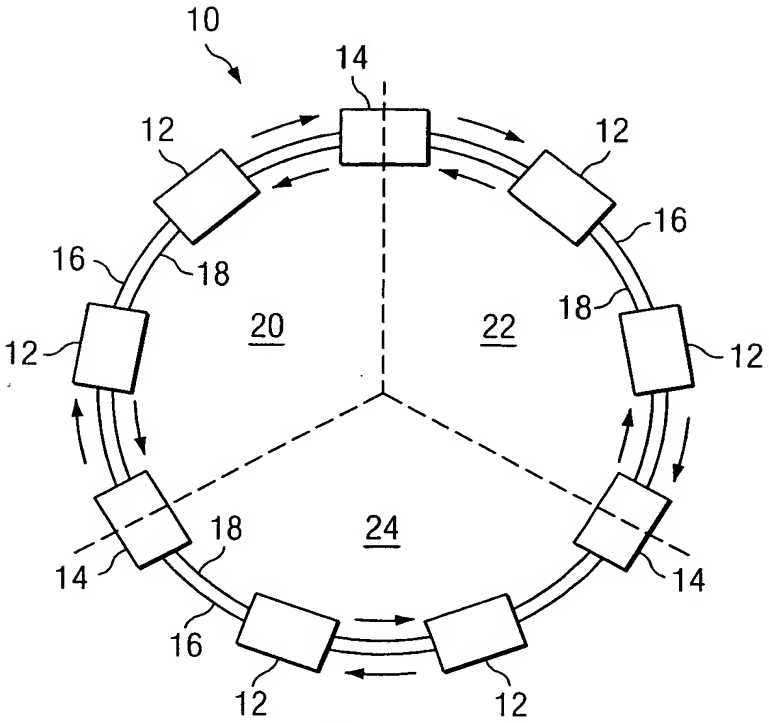

10
14
12
12
16
18
16
18
12
12
20
22
18
24
14
14
16
12
12

FIG. 1

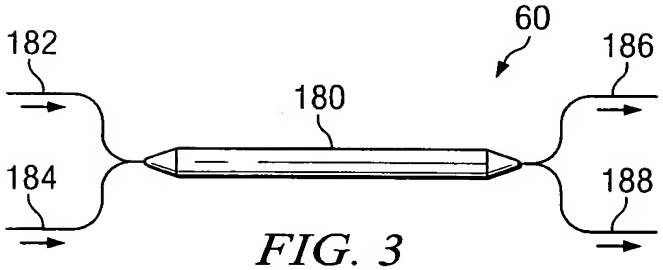

60
182
186
180
184
188

FIG. 3

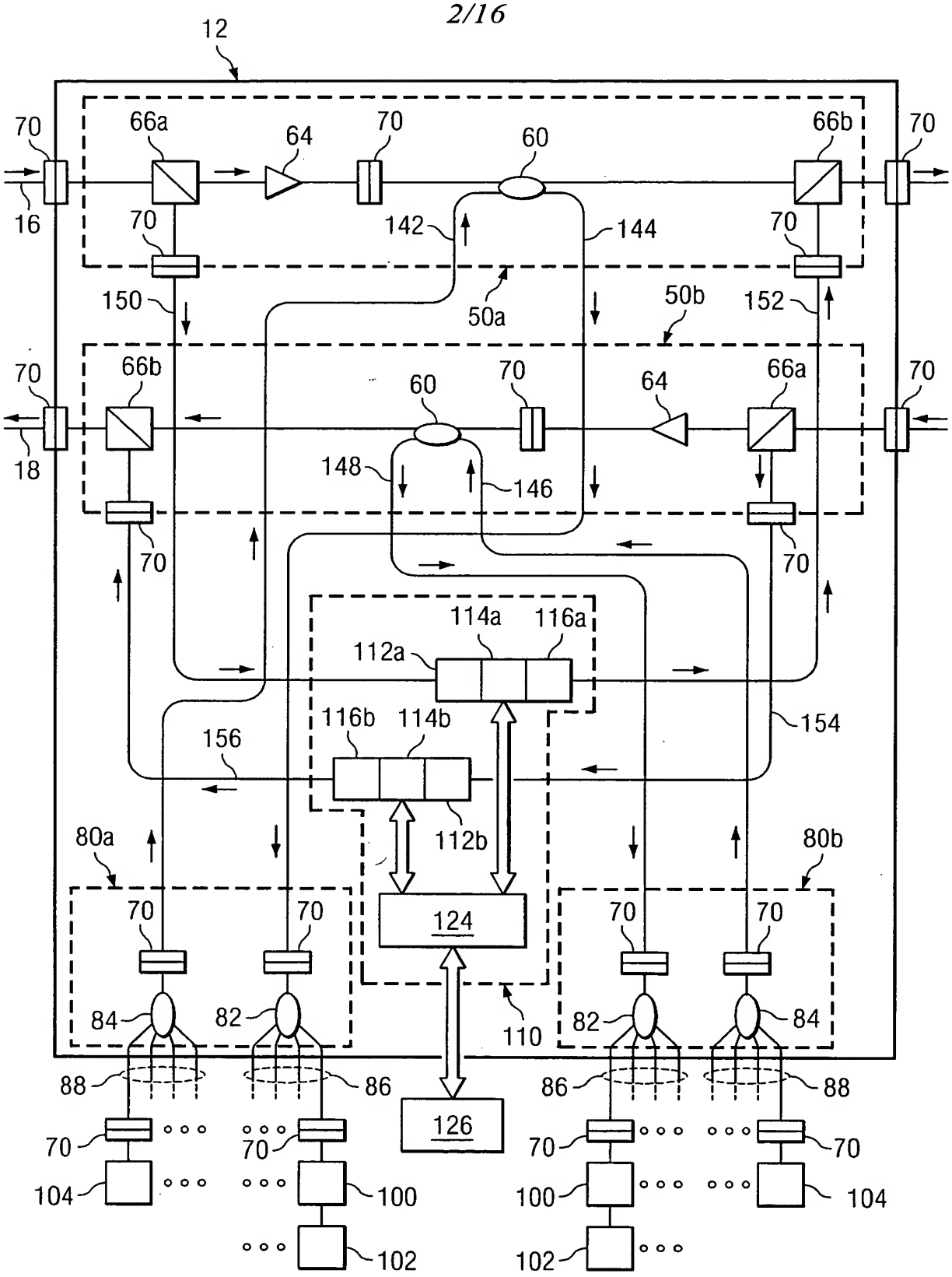

12
70
66a
64
70
60
66b
70
16
70
142
144
70
150
50a
50b
152
70
66b
60
70
64
66a
70
18
148
146
70
70
114a
116a
112a
116b
114b
154
156
112b
80a
80b
70
70
124
70
70
84
82
110
82
84
88
86
126
86
88
70
70
70
70
104
100
100
104
102
102

FIG. 2A

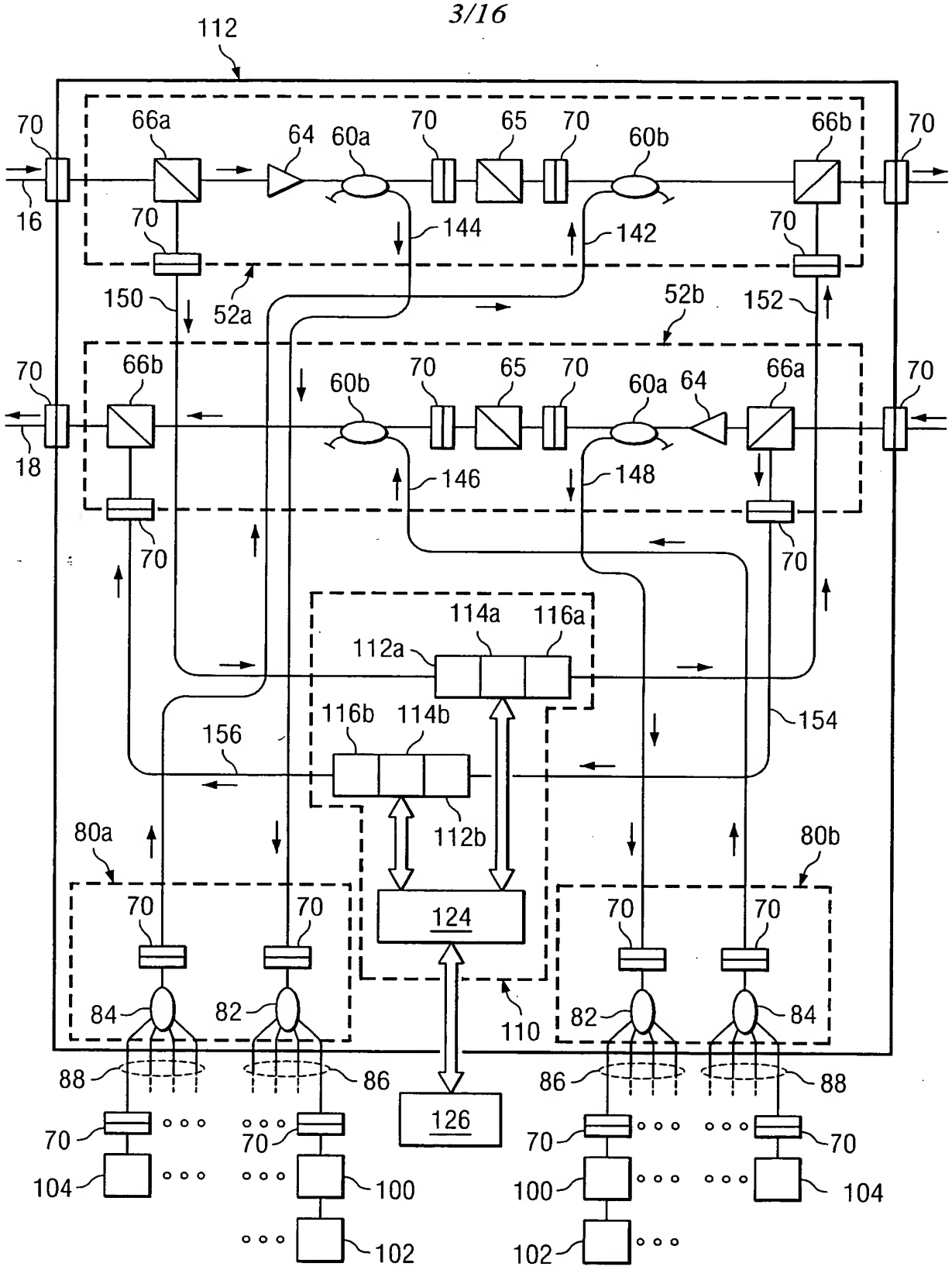

112
70
66a
64
60a
70
65
70
60b
66b
70
16
70
144
142
70
150
52a
52b
152
70
66b
60b
70
65
70
60a
64
66a
70
18
146
148
70
70
114a
116a
112a
116b
114b
154
156
112b
80a
80b
70
70
124
70
70
84
82
110
82
84
88
86
126
86
88
70
70
70
70
104
100
100
104
102
102

FIG. 2B

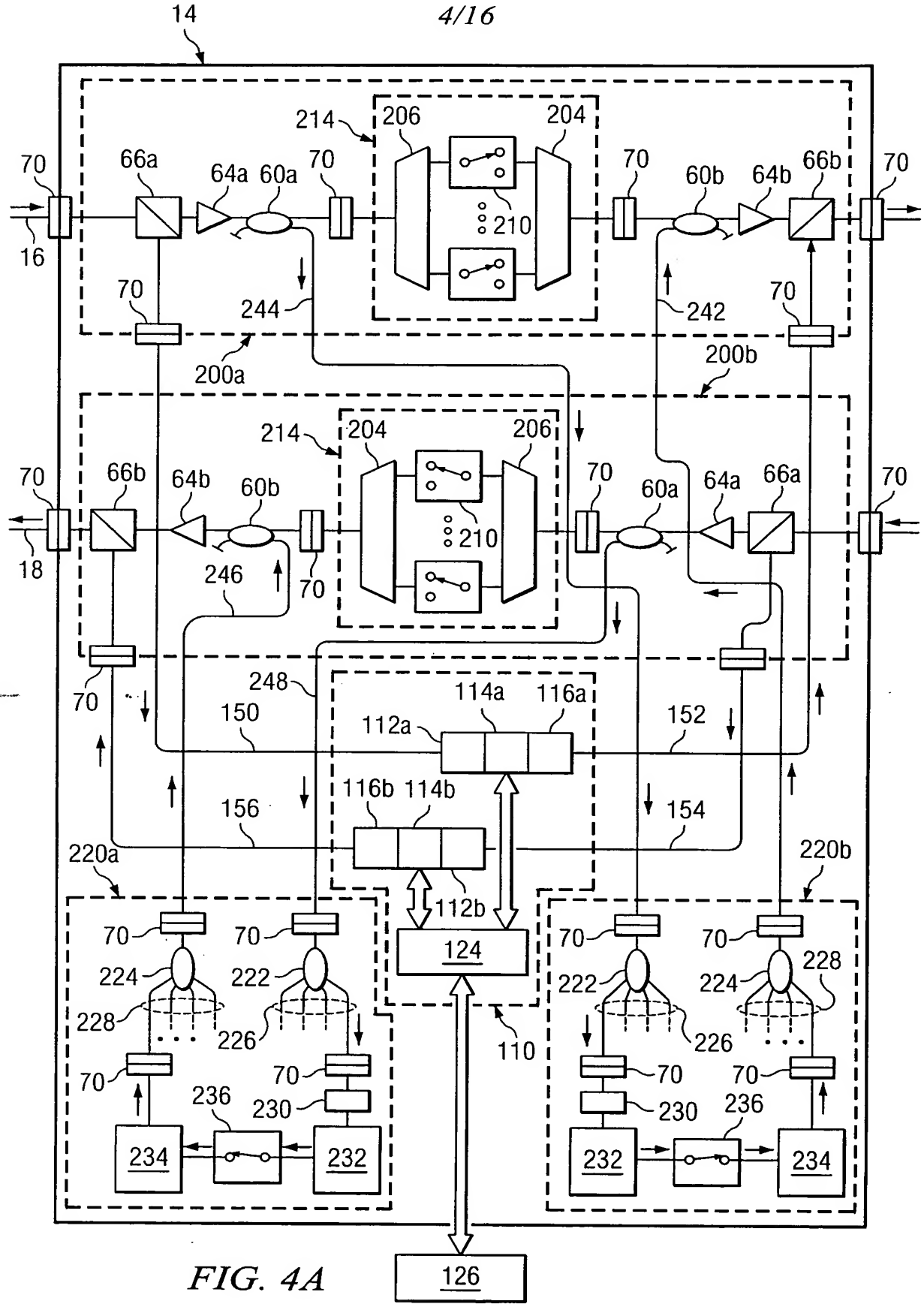

14
214
206
204
210
70
66a
64a
60a
60b
64b
66b
16
244
242
200a
200b
18
246
248
150
152
114a
116a
112a
116b
114b
156
154
220a
220b
112b
124
110
222
224
226
228
230
232
234
236
126

FIG. 4A

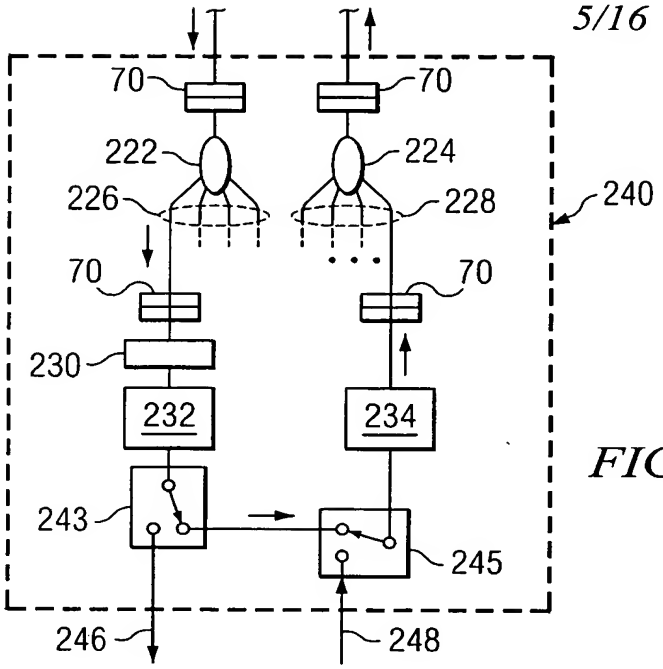
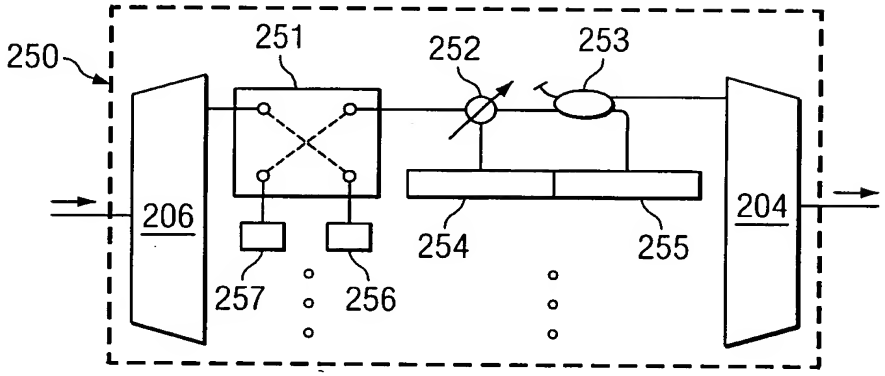


FIG. 4B

FIG. 4C



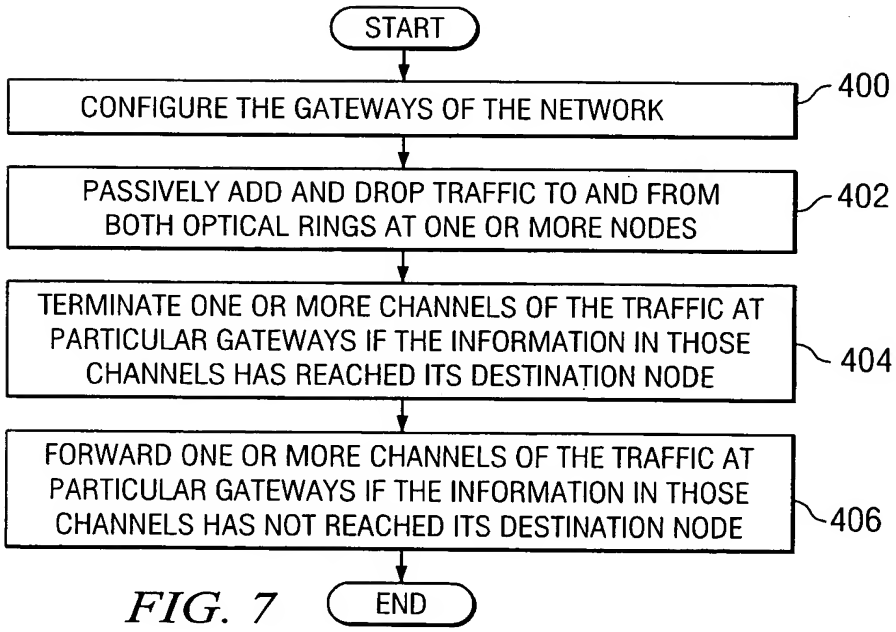


FIG. 7

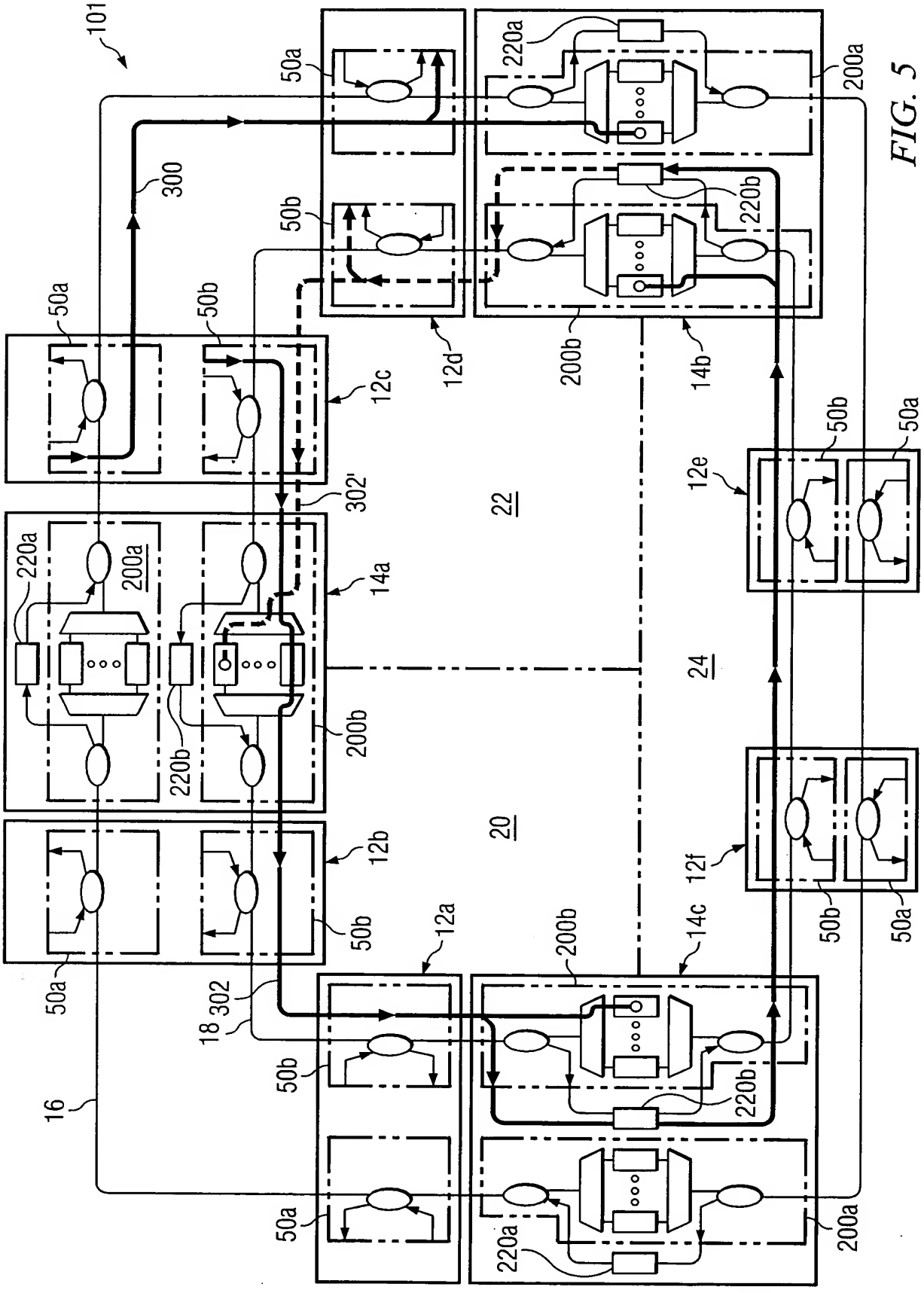

101
50a
50b
220a
200a
300
220b
12d
200b
14b
12c
12e
302'
22
14a
24
12b
20
12f
12a
14c
18
302
16

FIG. 5

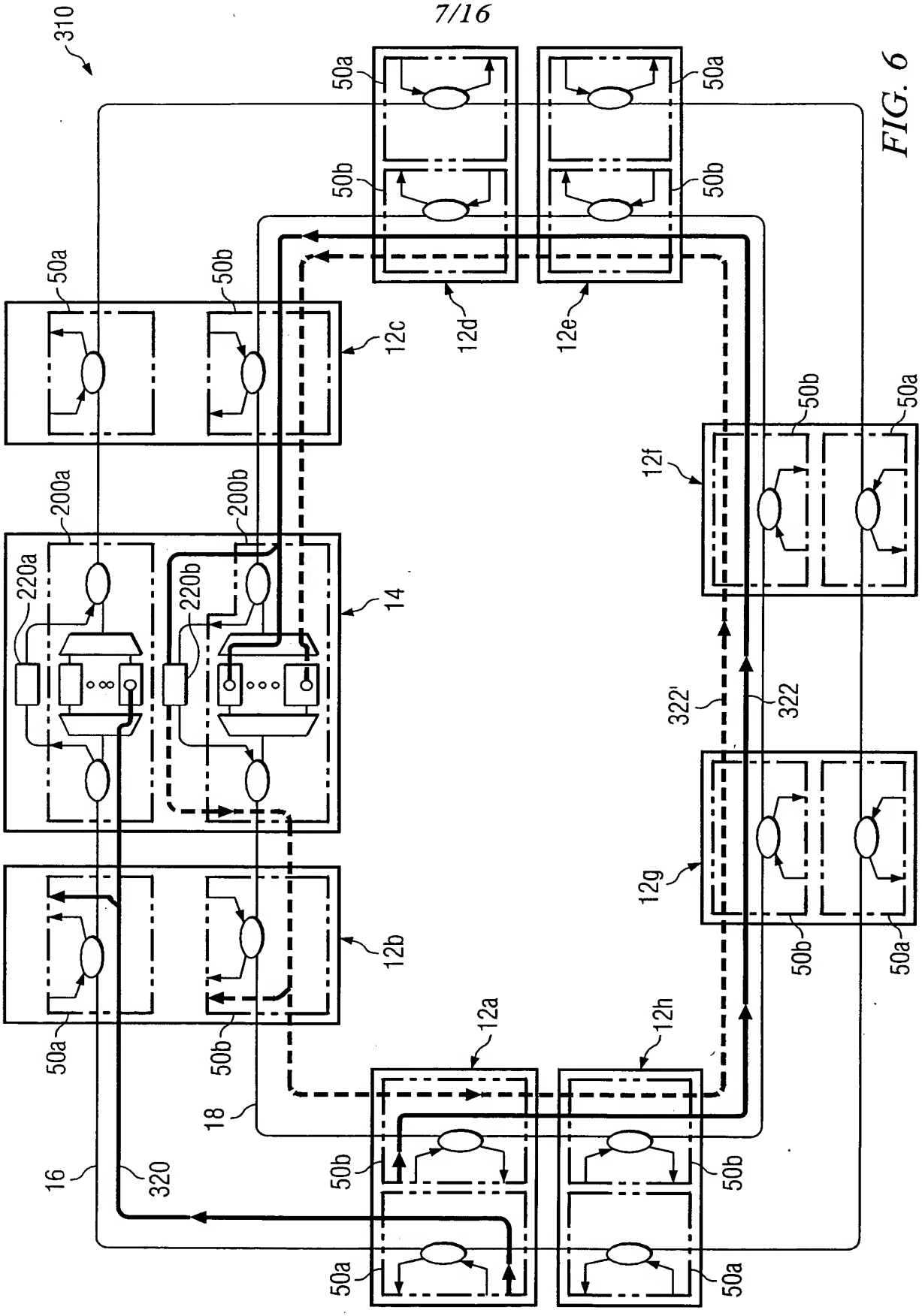

310
50a
50b
12c
12d
12e
12f
12g
12h
12a
12b
200a
200b
220a
220b
14
322'
322
18
16
320

FIG. 6

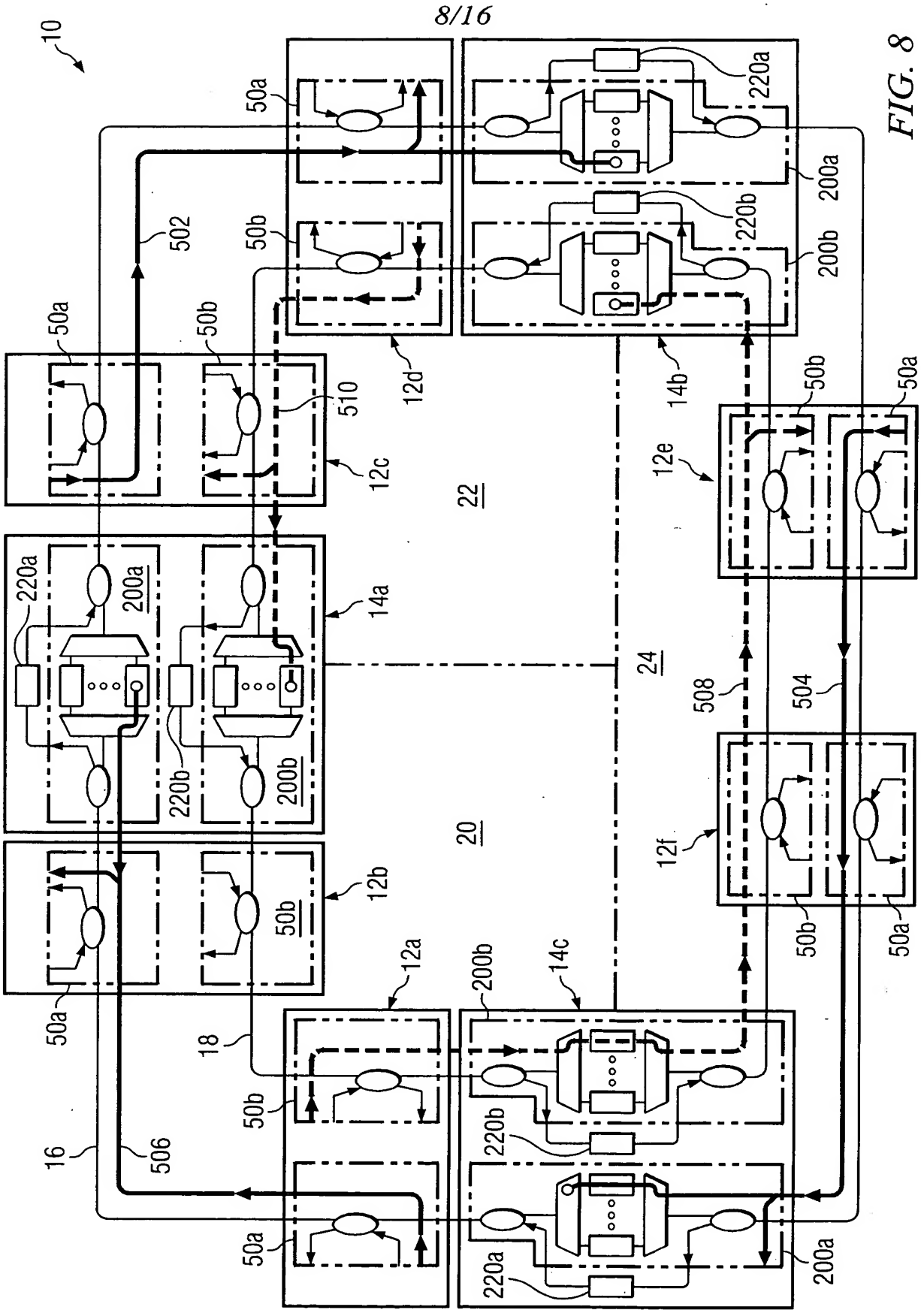

10
50a
50b
220a
200a
220b
200b
502
510
12d
14b
12c
22
12e
14a
24
508
504
12f
20
12b
12a
14c
18
16
506

FIG. 8

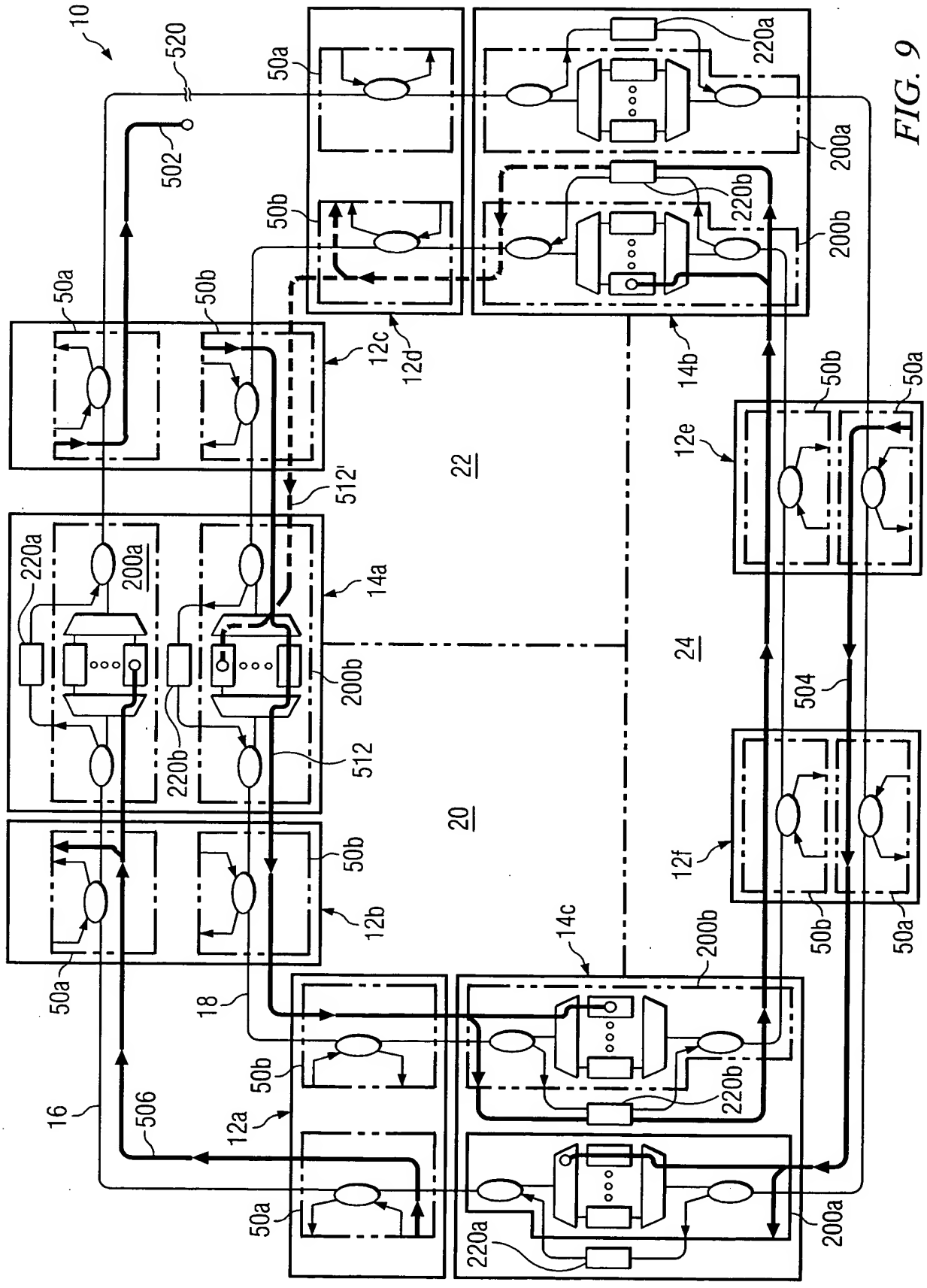

10
520
502
50a
50b
220a
220b
200a
200b
12c
12d
14b
12e
22
512'
14a
512
24
504
20
12f
12b
14c
18
16
506
12a

FIG. 9

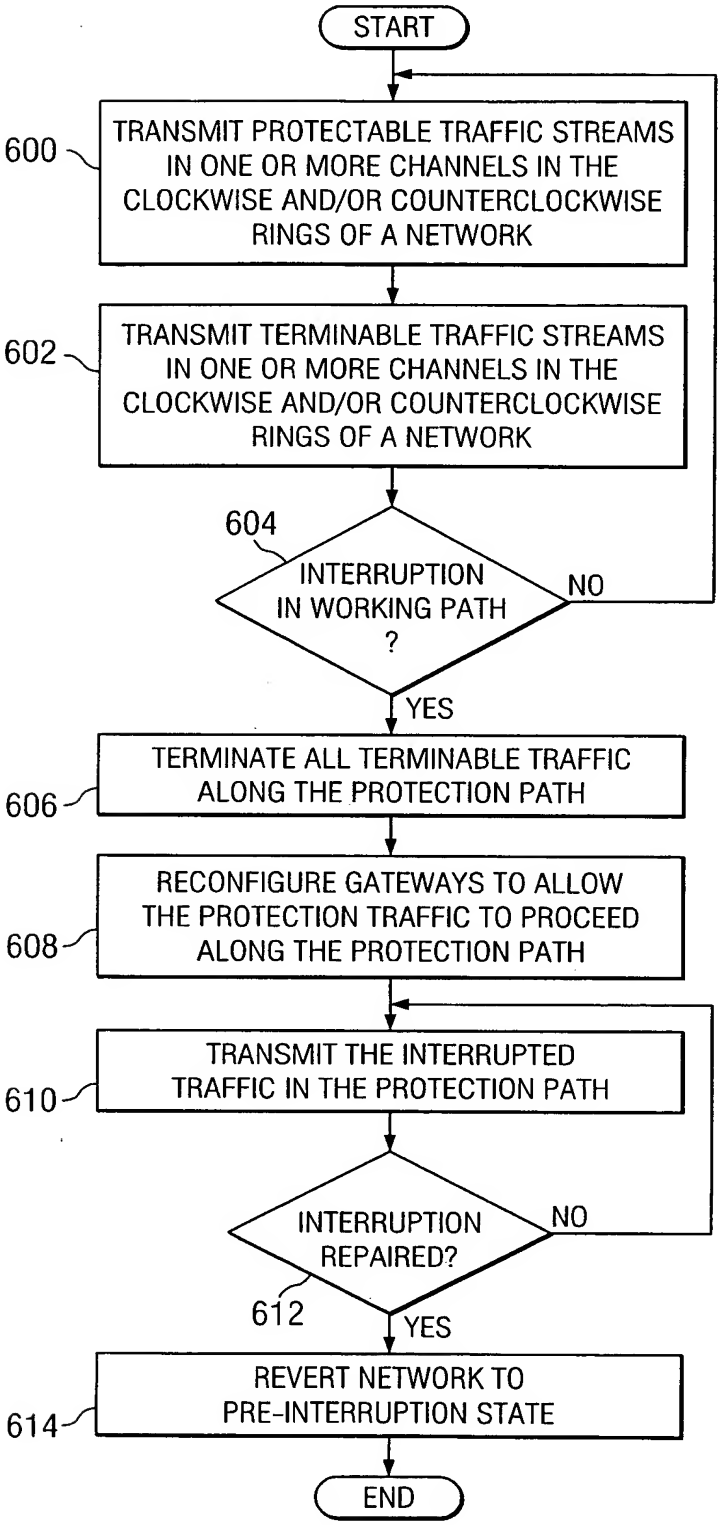

START
600
TRANSMIT PROTECTABLE TRAFFIC STREAMS IN ONE OR MORE CHANNELS IN THE CLOCKWISE AND/OR COUNTERCLOCKWISE RINGS OF A NETWORK
602
TRANSMIT TERMINABLE TRAFFIC STREAMS IN ONE OR MORE CHANNELS IN THE CLOCKWISE AND/OR COUNTERCLOCKWISE RINGS OF A NETWORK
604
INTERRUPTION IN WORKING PATH ?
NO
YES
606
TERMINATE ALL TERMINABLE TRAFFIC ALONG THE PROTECTION PATH
608
RECONFIGURE GATEWAYS TO ALLOW THE PROTECTION TRAFFIC TO PROCEED ALONG THE PROTECTION PATH
610
TRANSMIT THE INTERRUPTED TRAFFIC IN THE PROTECTION PATH
INTERRUPTION REPAIRED?
NO
612
YES
614
REVERT NETWORK TO PRE-INTERRUPTION STATE
END

FIG. 10

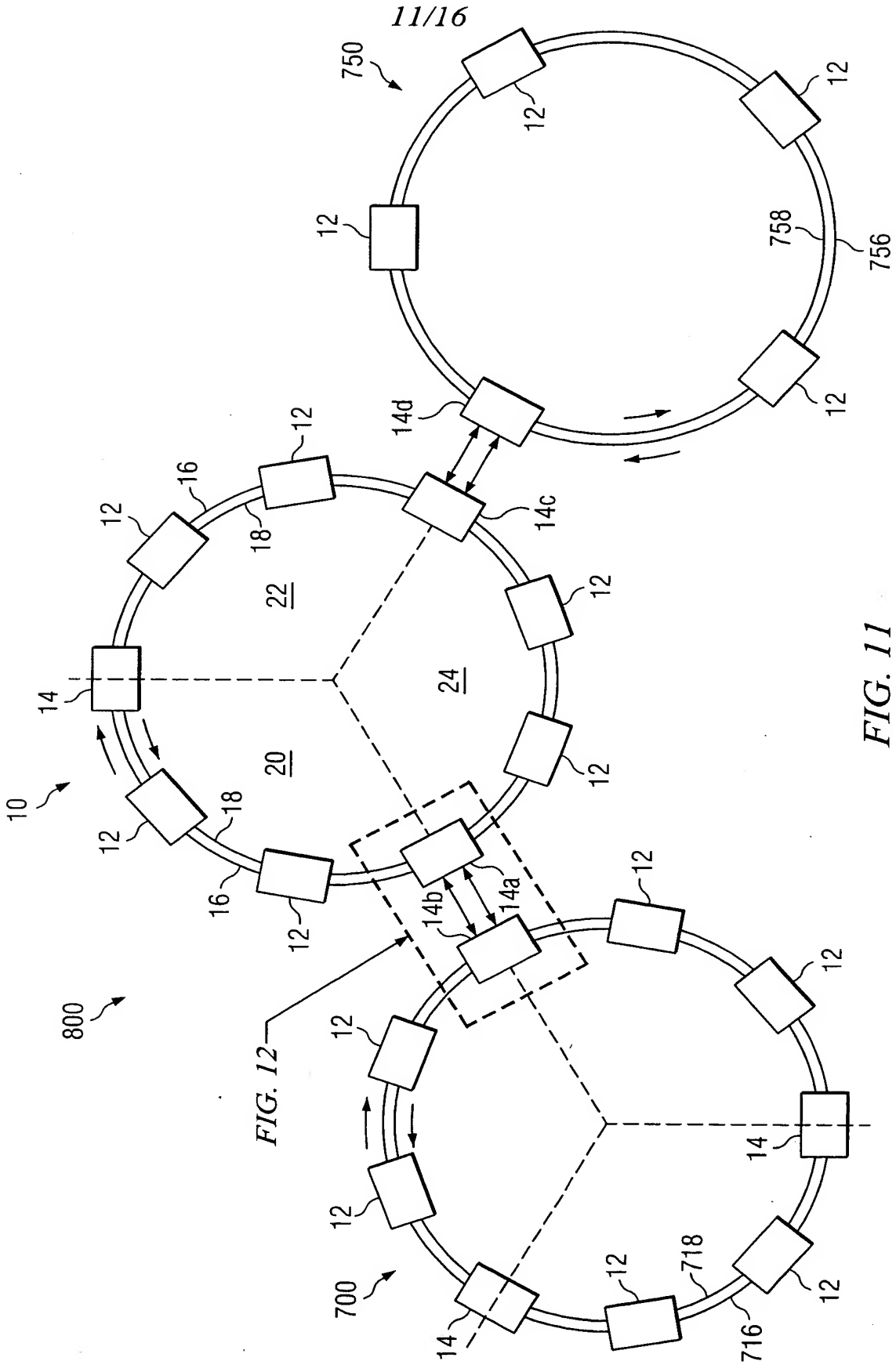
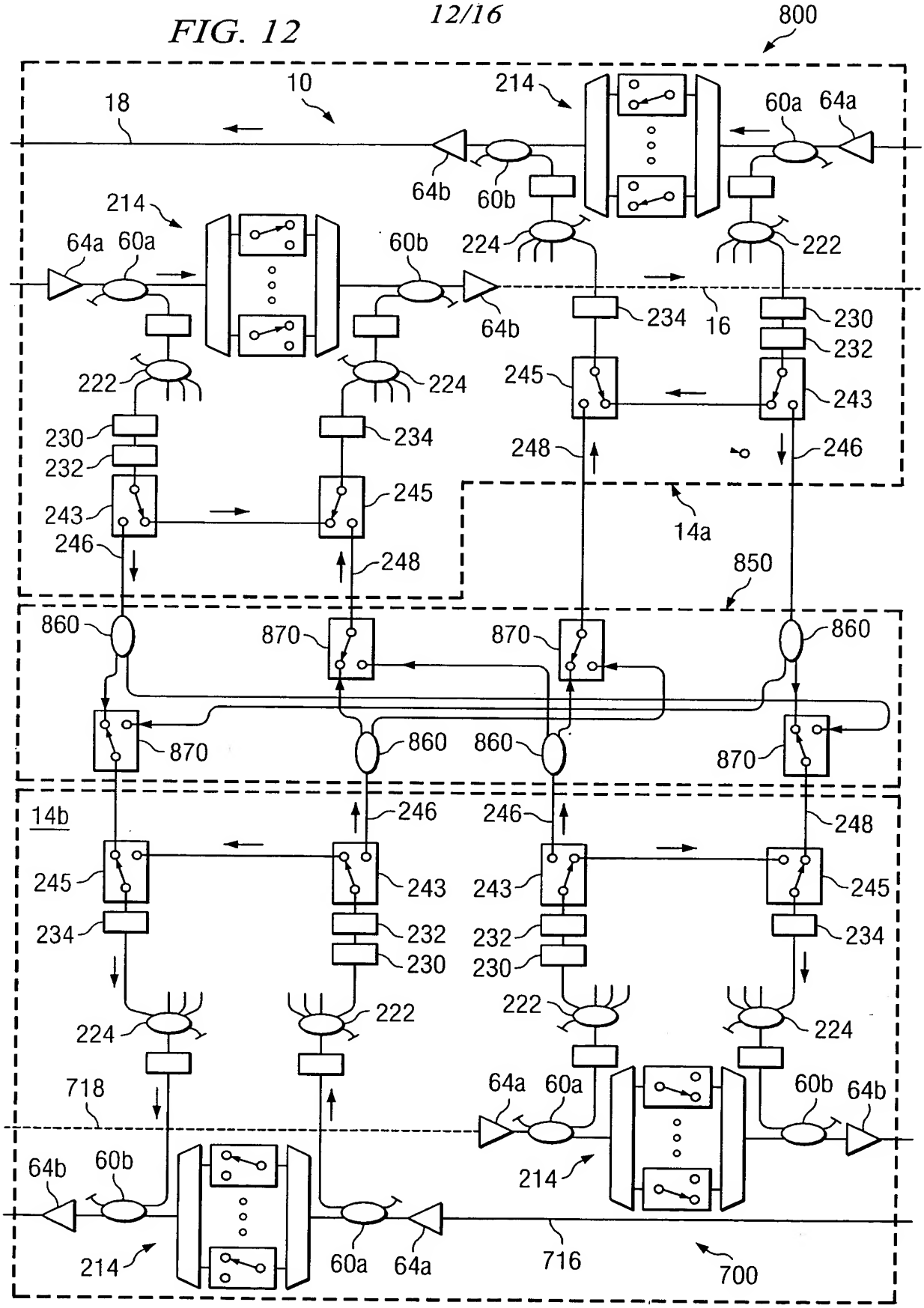


FIG. 11

FIG. 12

FIG. 12


800
10
18
214
60a
64a
64b
60b
224
222
234
16
230
232
245
243
248
246
14a
850
860
870
14b
718
716
700

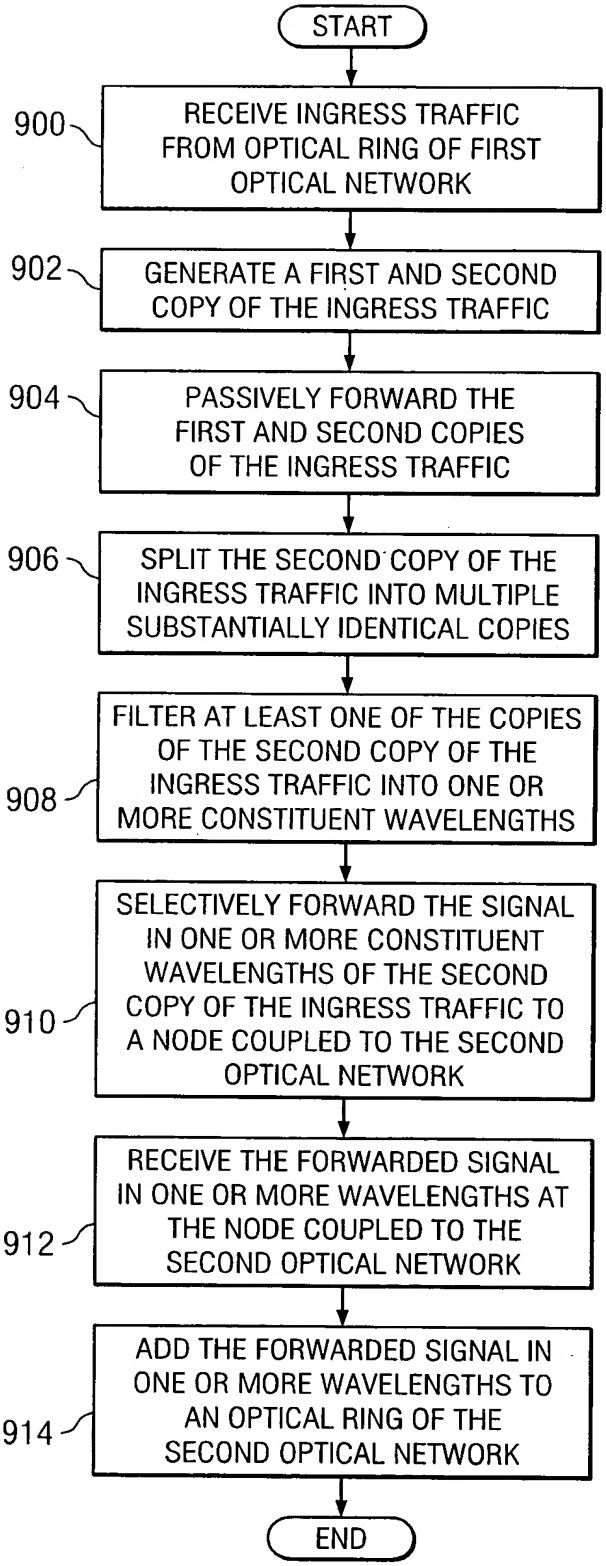

START
900
RECEIVE INGRESS TRAFFIC FROM OPTICAL RING OF FIRST OPTICAL NETWORK
902
GENERATE A FIRST AND SECOND COPY OF THE INGRESS TRAFFIC
904
PASSIVELY FORWARD THE FIRST AND SECOND COPIES OF THE INGRESS TRAFFIC
906
SPLIT THE SECOND COPY OF THE INGRESS TRAFFIC INTO MULTIPLE SUBSTANTIALLY IDENTICAL COPIES
908
FILTER AT LEAST ONE OF THE COPIES OF THE SECOND COPY OF THE INGRESS TRAFFIC INTO ONE OR MORE CONSTITUENT WAVELENGTHS
910
SELECTIVELY FORWARD THE SIGNAL IN ONE OR MORE CONSTITUENT WAVELENGTHS OF THE SECOND COPY OF THE INGRESS TRAFFIC TO A NODE COUPLED TO THE SECOND OPTICAL NETWORK
912
RECEIVE THE FORWARDED SIGNAL IN ONE OR MORE WAVELENGTHS AT THE NODE COUPLED TO THE SECOND OPTICAL NETWORK
914
ADD THE FORWARDED SIGNAL IN ONE OR MORE WAVELENGTHS TO AN OPTICAL RING OF THE SECOND OPTICAL NETWORK
END

FIG. 13

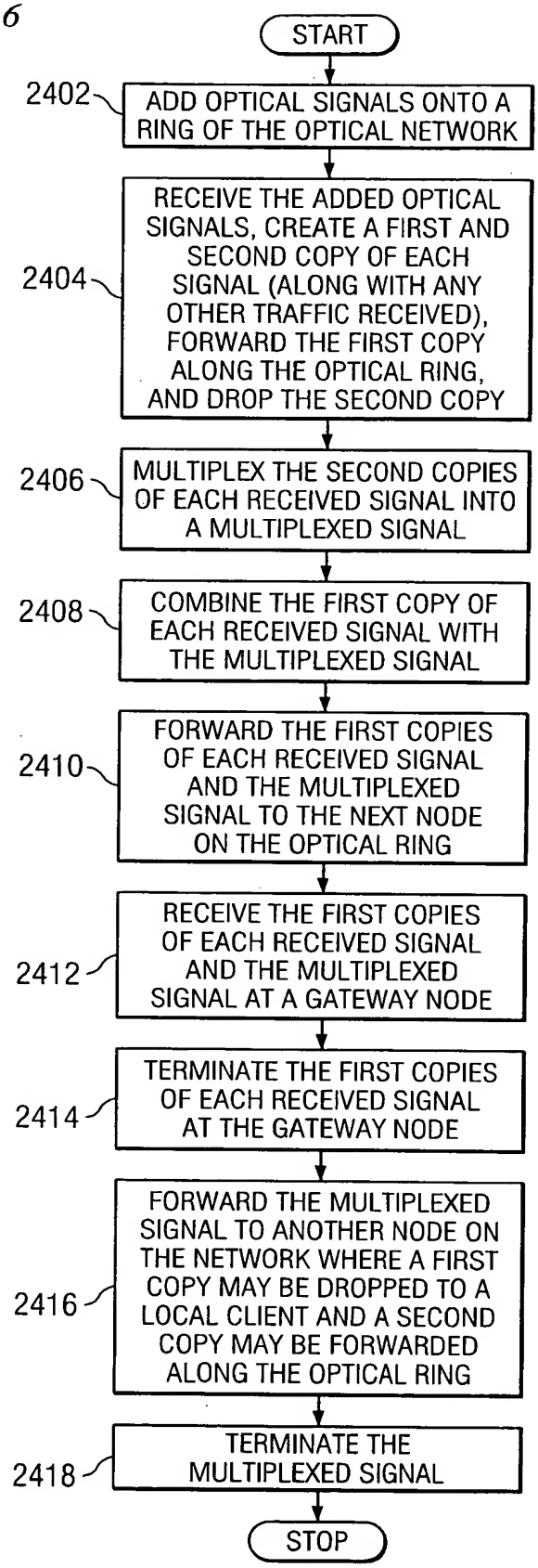
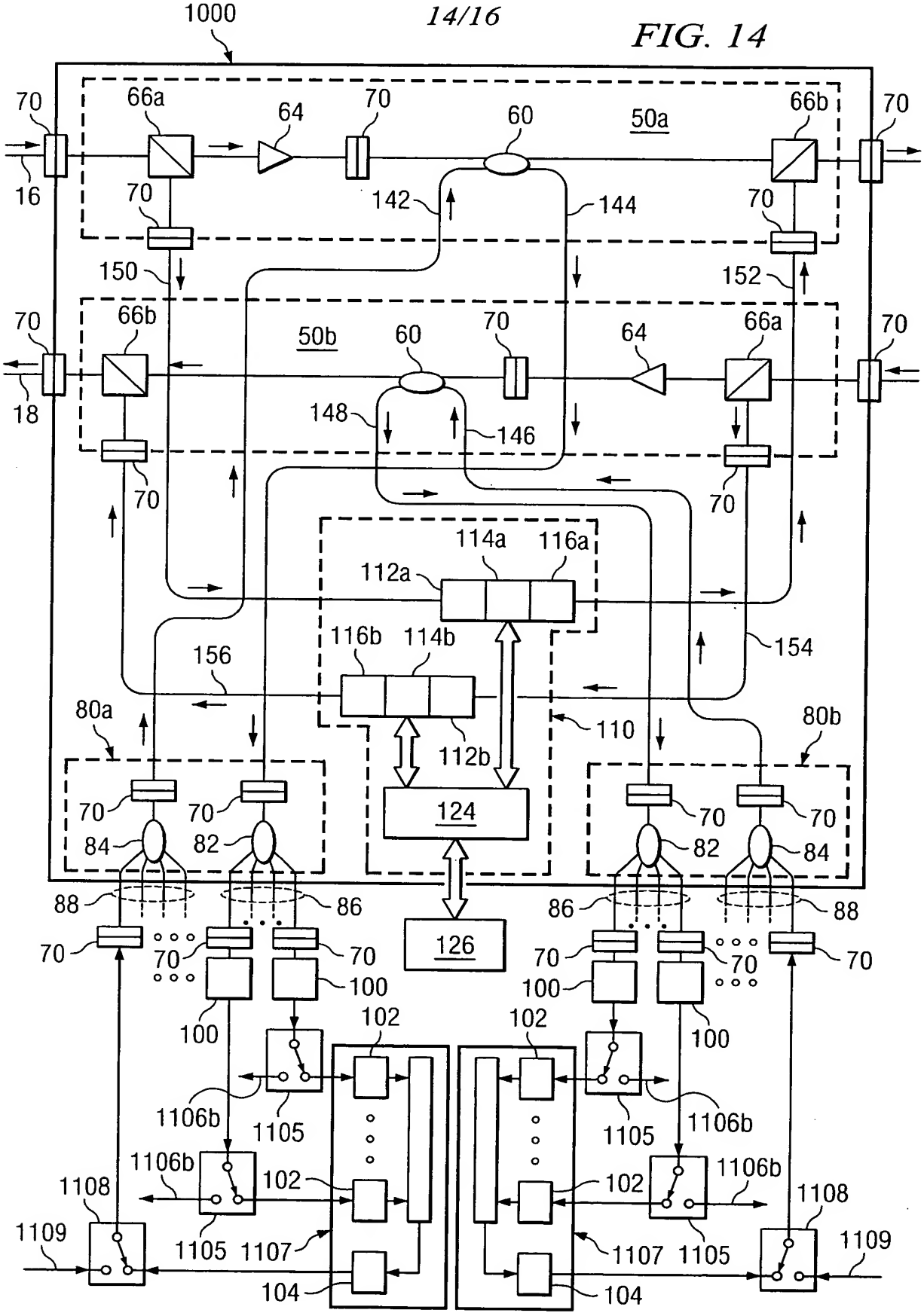

START
2402
ADD OPTICAL SIGNALS ONTO A RING OF THE OPTICAL NETWORK
2404
RECEIVE THE ADDED OPTICAL SIGNALS, CREATE A FIRST AND SECOND COPY OF EACH SIGNAL (ALONG WITH ANY OTHER TRAFFIC RECEIVED), FORWARD THE FIRST COPY ALONG THE OPTICAL RING, AND DROP THE SECOND COPY
2406
MULTIPLEX THE SECOND COPIES OF EACH RECEIVED SIGNAL INTO A MULTIPLEXED SIGNAL
2408
COMBINE THE FIRST COPY OF EACH RECEIVED SIGNAL WITH THE MULTIPLEXED SIGNAL
2410
FORWARD THE FIRST COPIES OF EACH RECEIVED SIGNAL AND THE MULTIPLEXED SIGNAL TO THE NEXT NODE ON THE OPTICAL RING
2412
RECEIVE THE FIRST COPIES OF EACH RECEIVED SIGNAL AND THE MULTIPLEXED SIGNAL AT A GATEWAY NODE
2414
TERMINATE THE FIRST COPIES OF EACH RECEIVED SIGNAL AT THE GATEWAY NODE
2416
FORWARD THE MULTIPLEXED SIGNAL TO ANOTHER NODE ON THE NETWORK WHERE A FIRST COPY MAY BE DROPPED TO A LOCAL CLIENT AND A SECOND COPY MAY BE FORWARDED ALONG THE OPTICAL RING
2418
TERMINATE THE MULTIPLEXED SIGNAL
STOP

FIG. 17

FIG. 14


1000
70
66a
64
70
60
50a
66b
70
16
70
142
144
70
150
152
70
66b
50b
60
70
64
66a
70
18
148
146
70
70
114a
116a
112a
116b
114b
156
154
80a
110
80b
112b
124
70
70
70
70
84
82
82
84
88
86
86
88
70
70
70
126
70
70
70
100
100
100
102
102
1106b
1105
1105
1106b
1106b
1106b
1108
102
102
1108
1109
1105
1107
1107
1105
1109
104
104

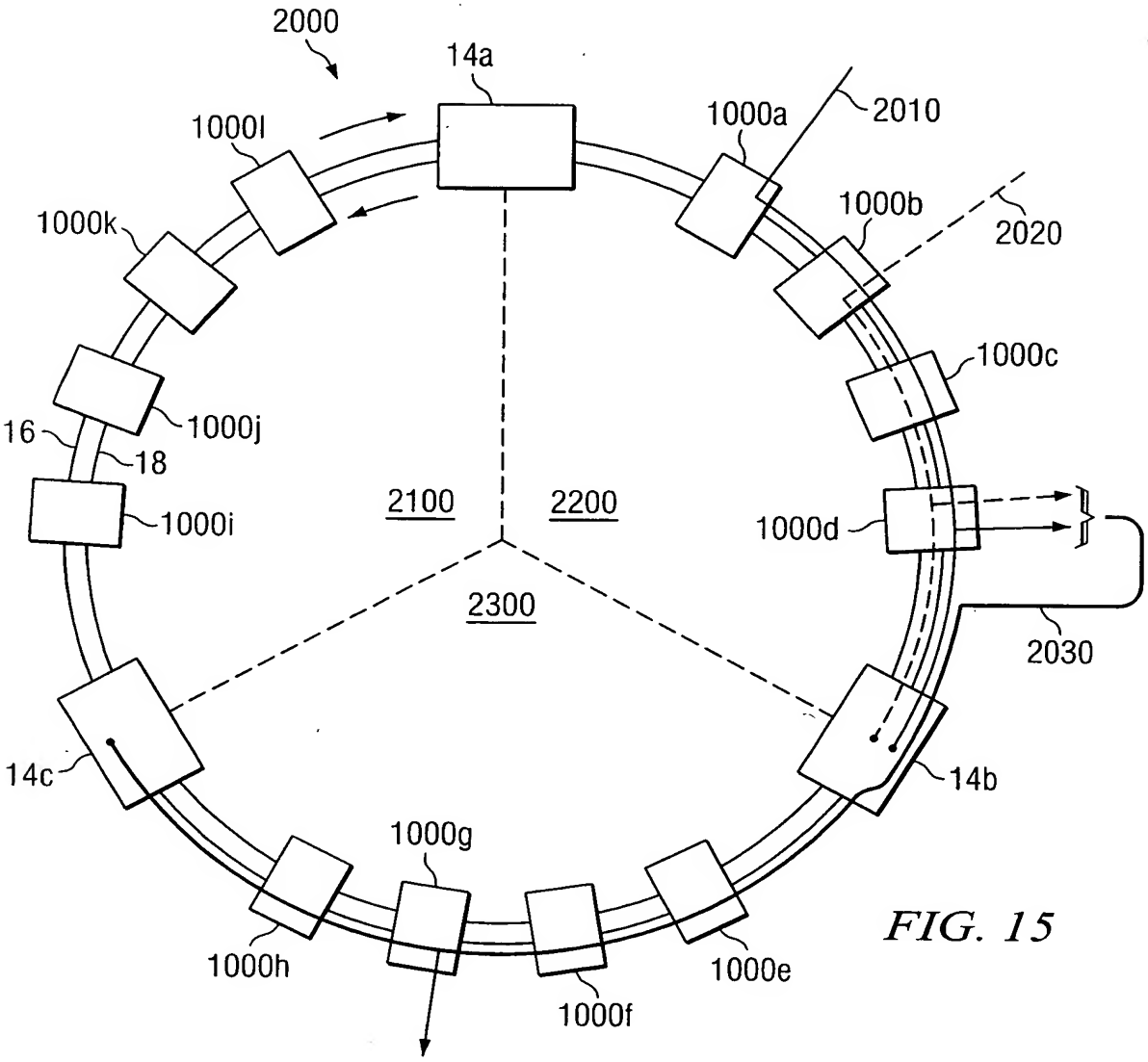

2000
14a
1000a
2010
1000b
2020
1000c
1000d
2030
14b
1000e
1000f
1000g
1000h
14c
1000i
1000j
16
18
1000k
1000l
2100
2200
2300

FIG. 15

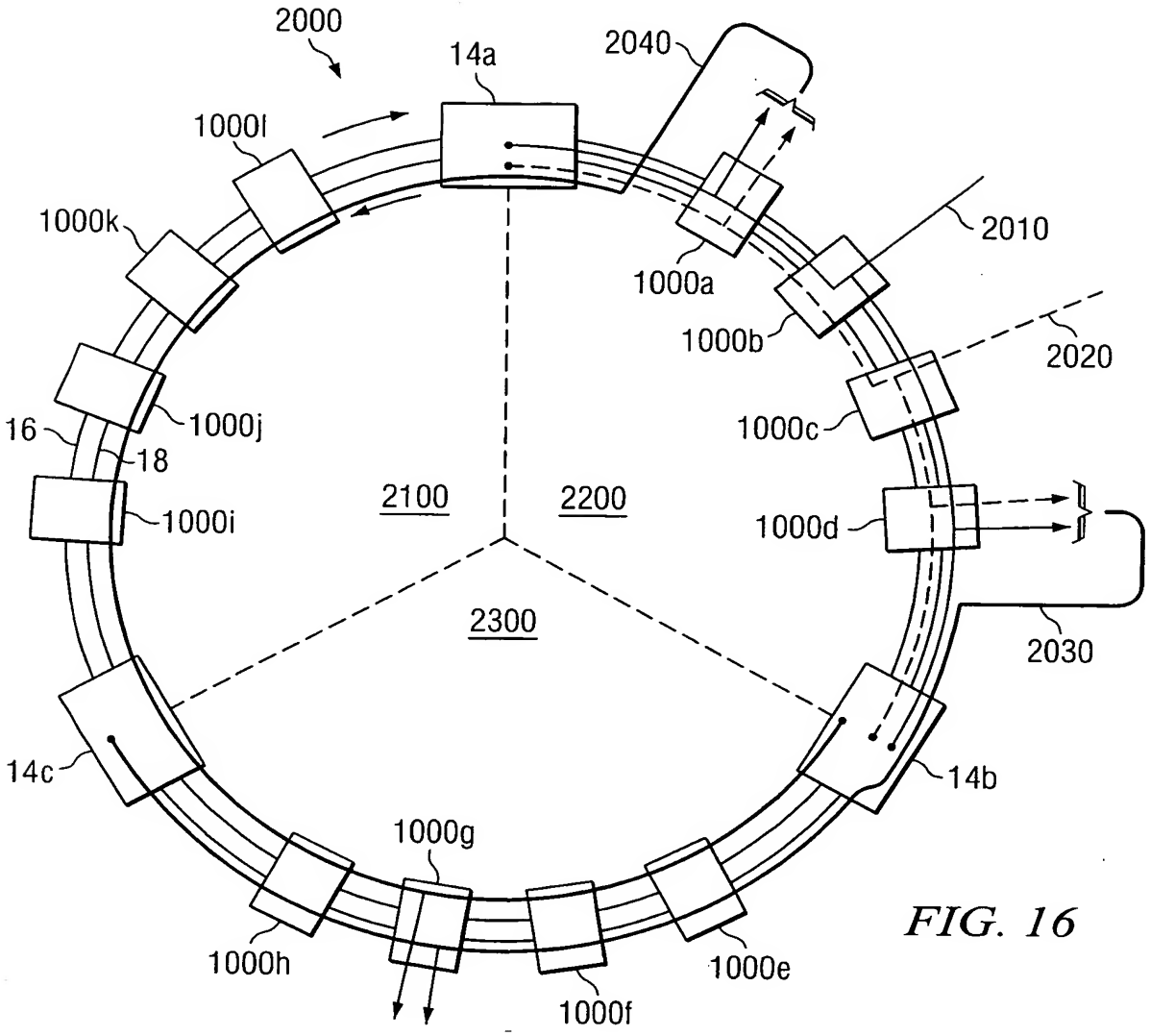

2000
14a
2040
1000l
1000k
2010
1000a
1000b
2020
16
1000j
18
1000c
2100
2200
1000i
1000d
2300
2030
14c
14b
1000g
1000h
1000e
1000f

FIG. 16